CERTIFICATE OF TRANSLATION

As a below named translator, I hereby declare that my residence and citizenship are as stated below next to my name and I hereby certify that I am conversant with both the English and Korean languages and the document enclosed herewith is a true English translation of the Priority Document with respect to the Korean patent application No. **10-2003-0008934** filed on **February 12, 2003.**

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[ABSTRACT OF THE DISCLOSURE]

[ABSTRACT]

In a mobile communication system comprising a Node B and multiple user equipments (UEs) capable of communicating with the Node B in a cell occupied by the Node B where multimedia broadcast/multicast service (MBMS) data can be transmitted from the Node B to a plurality of UEs among the multiple UEs, a method for the UEs requesting a predetermined MBMS service to receive an MBMS Notification for the MBMS service when RRC connection is set up after the predetermined MBMS service is requested, the method including transmitting, by each of the UEs, ID information of the MBMS service the UE requests to a radio network controller (RNC) when setting up RRC connection to the RNC.

[REPRESENTATIVE FIGURE]

FIGURE 7A

[INDEX]

MBMS, MBMS Service Context, Notification

[SPECIFICATION]

[TITLE OF THE INVENTION]

METHOD FOR MANAGING SERVICE CONTEXT AT RADIO NETWORK CONTROLLER IN A MULTIMEDIA BROADCAST/MULTICAST SERVICE

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 is a diagram schematically illustrating an example of a 3GPP mobile communication network for a Multimedia Broadcast/Multicast Service (MBMS) service according to the prior art;

FIG. 2 is a diagram illustrating a procedure for performing an MBMS service according to the prior art;

FIG. 3 is a diagram illustrating MBMS service contexts according to the prior art;

FIG. 4 is a diagram illustrating a Joining procedure for an MBMS service according to the prior art;

FIG. 5 is a diagram illustrating a procedure for releasing PS signaling by a UE that joined an MBMS service according to the prior art;

FIG. 6 is a diagram illustrating an example of problems in a 3GPP mobile communication network for an MBMS service according to the prior art;

FIG. 7A is a diagram illustrating a procedure for inserting an MBMS service ID to an RRC connection message according to a first embodiment of the present invention;

FIG. 7B is a diagram illustrating a procedure for transmitting an MBMS service ID by a UE to an RNC according to a second embodiment of the present invention;

FIG. 8 is a flowchart illustrating operation of a UE according to an embodiment of the present invention;

FIG. 9 is a diagram illustrating an operation flow of an RNC according to an embodiment of the present invention; and

FIG. 10 is a diagram illustrating an operation flow of an SGSN according to an embodiment of the present invention.

[DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT]

[OBJECT OF THE INVENTION]

[RELATED FIELD AND PRIOR ART OF THE INVENTION]

The "Multimedia Broadcast/Multicast Service (MBMS) service" refers to a service for transmitting the same multimedia data to a plurality of recipients through a radio network. In the MBMS service, recipients can share one radio channel to save radio transmission resources.

FIG. 1 is a diagram schematically illustrating nodes joining an MBMS service. UEs 161, 162, 163, 171, and 172 are terminal equipments or subscribers for receiving an MBMS service, and a cell #1 160 and a cell #2 170 are controlled by their own base station apparatuses, which transmit MBMS-related data to subscribers. A radio network controller (RNC) 140 controls the cells 160 and 170, selectively transmits multimedia data to a particular cell, and controls a radio channel set up to provide an MBMS service. A serving GPRS (General Packet Radio Service) support node (SGSN) 130 controls an MBMS service for each subscriber. For example, typical functions of the SGSN 130 include managing service accounting-related information of each subscriber and selectively transmitting multimedia data to the particular RNC 140. A transit network (NW) 120 provides a communication path between a broadcast multicast service center (BM-SC) 110 and the SGSN 130, and can be connected to an external network via an undepicted gateway GPRS support node (GGSN). The BM-SC 110 is a source of MBMS data, and controls scheduling of MBMS data. Although not illustrated in FIG. 1, a home location register (HLR) may be

connected to the SGSN for subscriber authentication.

As illustrated in FIG. 1, an MBMS data stream is transferred to the UEs 161, 162, 163, 171, and 172 via the transit network 120, the SGSN 130, the RNC 140, and the Node Bs 160 and 170. Although not illustrated in FIG. 1, for one MBMS service, a plurality of SGSNs and a plurality of RNCs for each SGSN can be used. Each of the SGSNs selectively transmits data to its RNCs, and each of the RNCs selectively transmits data to its cells. To this end, a list of nodes to which a data stream should be transmitted is stored in the SGSN and RNC (i.e., a list of RNCs is stored in each SGSN, and a list of cells is stored in each RNC), to later selectively transmit MBMS data only to the nodes stored in the list.

Operations to be carried out between an UE and a network to provide an MBMS service are schematically illustrated in FIG. 2.

First, in a Subscription step 201, a user who desires to receive an MBMS service is registered in a service provider. In the Subscription step, the user exchanges fundamental information related to accounting or service reception with the service provider. In an Announcement step 202, service announcement for an MBMS service is performed. In step 202, UEs which desire to receive an MBMS service may detect fundamental information on an MBMS service, such as IDs (MBMS service IDs) of MBMS services available in the BM-SC 306, and their service start time and duration. For example, the MBMS service ID includes a multicast address and an access point name (APN).

After acquiring the fundamental MBMS service information in step 202, the UEs 161 – 172 perform a Joining step 203 in order to receive its desired MBMS service. In the Joining step 203, the UE 302 sends the MBMS service IDs obtained in the Announcement step 202 to the BM-SC 110 through a

message. Through this procedure, an MBMS context for managing an MBMS service is created in the UE and the MB-SC 110. In addition, nodes interposed between the BM-SC and the user, i.e., the SGSN 140 and the transit network 150, detect the UEs which desire to receive an MBMS service and the nodes where the UEs are located. For example, the SGSN 130 may recognize a list of the UEs and a list of RNCs where the UEs are located, and transmit MBMS data to only the RNCs where the UEs are located by consulting the lists.

A Notification step 205 is for paging the UE 302 in order to inform that the MBMS service joined by the UE 302 will be initiated soon.

A Radio Resource Allocation step 206 is a step for actually allocating a radio resource to provide the MBMS service, and then notifying the information to related nodes. In the step 206, the RNC can select a point-to-multipoint (PtM) or a point-to-point (PtP) connection method based on information on the number of UEs belonging to each of its cells and a radio resource management function.

After step 206 is completed, in a Data Transfer step 207, actual MBMS data is transferred to the UE 302 via the RNC 304. In addition, in step 207, ciphering key update may also be performed. For example, if a ciphering key for the MBMS service must be changed, the RNC delivers a new ciphering key to all UEs receiving the MBMS service.

If the MBMS service is ended, in a Radio Resource Release step 208, the radio resource allocated in step 206 is released and a message such as MBMS RB RELEASE is transferred to all UEs which are receiving the MBMS service. While receiving the MBMS service, the UE can spontaneously request suspension of the MBMS service.

In order for UEs to access a network and receive a service therefrom, a context, which is a set of information necessary for providing the corresponding service, must be first created between the UEs and network nodes. According to the prior art, if a UE accesses an RNC and sets up RRC connection, the RNC creates a UE context for the UE. The UE context includes fundamental information such as a UE identity (ID), position information of a UE, RRC state information of the UE, and information on a radio resource assigned to the UE. Further, the UE context is managed by an RNC while RRC connection is activated. As another example, a mobility management (MM) context is used to manage a position of a UE in a core network (CN). In order for a UE to receive a PS service, an MM context of the UE must be first created in an SGSN and a GGSN through a GPRS Attach procedure. Particularly, an MM context of the SGSN includes UE ID such as IMSI (International Mobile Subscriber Identity), P-TMSI (Temporary Mobile Subscriber Identity), IMEI (International Mobile Equipment Identity), and MS-ISDN (Mobile Subscriber ISDN (Integrated Switched Data Network)) Number, position information such as RA (Routing Area) and SAC (Service Area Code), authentication/encryption-related information, accounting information, and DRX (Discontinuous Reception) parameters.

Meanwhile, in network nodes for an MBMS service, a new context for MBMS has to be defined. To this end, an existing context described above may be extended for use or a context for MBMS may be newly defined. For newly defined MBMS context, since a plurality of UEs simultaneously receive the same information in MBMS, the context may also be created for each service or each session of a service, rather than being individually created for each UE.

In order to perform an MBMS service, an MBMS service context must first be created in UEs and a BM-SC, which are front-end points of the MBMS

service. Also, an MBMS service context is created in an RNC, SGSN, and GGSN, which are network nodes used for transmitting MBMS data. Through the Joining step 203 of the UE, the MBMS context is created in the network nodes and MBMS data can be efficiently transmitted by using information at a point of time when the MBMS data is to be actually transmitted. A point of time when the MBMS context is created and a management method vary according to the role of each of the network nodes.

FIG. 3 illustrates a structure of an MBMS context (or MBMS service context) created by an RNC and an SGSN.

An MBMS service context of an SGSN 301 includes an MBMS service ID , a UE ID list, an RNC ID list, an SAC list , Multicast Area list, QoS (Quality of Service) information, and MBMS PDP (Packet Data Protocol) Context information. The MBMS service ID can be an identity (Multicast address/APN or MBMS Group Identity (IMGI)) permanently allocated to the corresponding MBMS service, or an identity (Temporary MBMS Group Identity (TMGI)) temporarily allocated to identify an MBMS service by a corresponding SGSN (or GGSN). In the latter case, i.e., TMGI, The SGSN (or GGSN) allocates the TMGI value when it first creates an MBMS service context for the MBMS service. The UE ID list has IDs of UEs belonging to a corresponding SGSN among UEs joining a corresponding MBMS service. A UE ID in the MBMS service context is used as a pointer pointing an MM context in the SGSN 421. Because a mapping relation between an MBMS service context and an MM context is held by the UE ID, the MM context (e.g., MM state information) necessary for an MBMS service is not repeatedly stored in the MBMS service context. The RNC ID list is a set of RNCs to which UEs included in the UE ID list belong. By using the RNC ID list, the SGSN can transmit MBMS data only to RNCs to which UEs actually requesting an MBMS service belong, rather than transmitting the MBMS

data to all of its RNCs. The SAC list and the multicast area list represent service areas where the MBMS service is available. The QoS information includes such attributes as traffic class, date rate, SDU (Service Data Unit) format information, and SDU error rate of MBMS data to be transmitted.

MBMS service contexts of an RNC have a different format according to whether it is a serving RNC (SRNC) for managing RRC connection of a UE or a control RNC (CRNC) where the UE is physically located. In other words, the MBMS service context of the SRNC 302 may include an MBMS service ID and a UE ID list, and an MBMS service context of the CRNC 303 may include an MBMS service ID, a UE ID list, and MBMS bearer-related information. The MBMS bearer-related information includes information on a radio access bearer (RAB) between the RNC and the SGSN, and information on a radio bearer (RB) between the RNC and the UE. The RAB information exists for each MBMS service of each RNC for a single QoS, and the RB information exists for each MBMS service of each cell for a single QoS.

The Joining step 203 of FIG. 2 will now be described in detail with reference to FIG. 4.

Reference numeral 401 represents a UE receiving an MBMS service, reference numeral 411 represents an RNC for an MBMS service, associated with the UE 401. Reference numeral 421 represents an SGSN of a core network (CN) for the MBMS service. The MBMS Service Announcement step 202 is a step for notifying UEs of the MBMS service, and the UE 401 acquires IDs of MBMS services available in its cell through the MBMS Service Announcement step 202. If an RRC connection is not set up between the UE 401 and the RNC 411, the UE 401 sets up an RRC connection to the RNC 404 in RRC connection setup step 431, in order to join a desired MBMS service.

The UE 401 transmits an ID of a desired MBMS service among MBMS services in a corresponding cell, acquired through the MBMS Service Announcement step, to the SGSN 421, along with an Activate MBMS Context Request message 441.

In order to transmit the Activate MBMS Context Request message 441 which is a non-access stratum (NAS) message, initial direct transfer is used between the UE 401 and the RNC 411, and an initial UE message is used between the RNC 411 and the SGSN 421.

Upon receiving the Activate MBMS Context Request message 441, the SGSN 421 authenticates the UE 401 in step 414 through a Security Function procedure 451 for inquiring of an authentication center about whether the UE 401 is a valid UMTS user. If the UE 401 is a first UE that requests the MBMS service, the SGSN 421 preferentially performs an operation of generating the MBMS service context for the MBMS service. The SGSN 421 then stores information on the UE 401 in the context and performs necessary operations with the GGSN.

The SGSN 421 transmits an Activate MBMS Context Accept message 442 to the UE 401 to inform that a request for joining the MBMS service is successfully accepted. The Activate MBMS Context Accept message 442 can include the MBMS service ID and a DRX parameter. The MBMS service ID transmitted along with the Activate MBMS Context Accept message 442 is a temporary MBMS service identity (TMGI), allocated to an activated MBMS service.

Because the Activate MBMS Context Request message 441 and the

Activate MBMS Context Accept message 442 are transparently transferred between the UE 401 and the SGSN 421, the RNC 404 cannot know whether the UE 401 has requested the MBMS service. Therefore, the SGSN 421 instructs the RNC 404 to update the MBMS service context through a Create MBMS Context Request message 461. The Create MBMS Context Request message 461 includes a UE ID and an MBMS service ID. The MBMS service ID in the Create MBMS Context Request message 461 is an identity permanently allocated to a service, such as an MBMS Multicast address, or a temporary identity (TMGI) allocated to the MBMS service. Herein, it should be understood that the MBMS service ID corresponds to both of the two identities. If the UE 401 is a first UE that requested the MBMS service, the RNC 404 preferentially performs an operation of creating the MBMS service context for the MBMS service.

Upon receiving the Create MBMS Context Request message 461, the RNC 421 stores the UE ID in the context and responds to the SGSN 421 through a Create MBMS Context Response message 462.

FIG. 5 is a diagram illustrating PS signaling being released because MBMS data transmission is not initiated yet even though a predetermined time has passed after a UE joined an MBMS service through the procedure illustrated in FIG. 4. Reference numeral 501 represents an UE receiving an MBMS, and reference numeral 511 represents an RNC for an MBMS service corresponding to the UE 501. Reference numeral 521 represents an SGSN of a CN for the MBMS service.

The SGSN 521 determines to release PS signaling upon detecting no message exchange between the UE 501 and the CN. Through a Delete MBMS Context Request message 531, the SGSN 521 requests deletion of the UE 501 from a UE ID list in the MBMS service context. Upon receiving the Delete

MBMS Context Request message 531, the RNC 501 deletes information on the UE 501 from the MBMS service context, and responds through a Delete MBMS Context Response message 532. If the UE 501 is a last UE that joined the MBMS service, the RNC deletes the MBMS service context and transmits an MBMS Service Deregister message 521 to the SGSN 521. After receiving the message 561, the SGSN deletes the RNC from an RNC list in the MBMS service context. The SGSN 521 releases Iu-PS signaling through an Iu release procedure 541. Therefore, the Iu-PS signaling-released UE transitions to a PMM-Idle mode having no PS signaling. In an MBMS service Deregister step 551, if the UE does not use RRC connection for Circuit Switched (CS) service, the RRC connection may also be released.

The MBMS service contexts in the SGSN 421 and the RNC 404 can be created, updated, and released through the procedures illustrated in FIGs. 4 and 5. However, when the MBMS service context is managed as described above, there may be a UE that fails to receive a Notification indicating initiation of MBMS data transmission information.

FIG. 6 illustrates in detail such a problem. Reference numeral 601 represents an UE receiving an MBMS, and reference numeral 611 represents an RNC for an MBMS service corresponding to the UE. Reference numeral 621 represents an SGSN of a CN for the MBMS service. In FIG. 6, the UE has joined the MBMS service through the procedure illustrated in FIG. 4 and transitions to the PMM-Idle mode having no PS signaling through the procedure illustrated in FIG. 5.

In step 631, the UE performs RRC connection setup for circuit service 631 to receive a CS service, and switches to Cell FACH or Cell DCH of an RRC Connected mode. The SGSN 621 recognizes initiation of MBMS data

transmission through an MBMS Service Availability message 641. The MBMS Service Availability message 641 may include an MBMS service ID, Multicast Area information, and QoS information. The SGSN 621 notifies all RNCs included in an RNC ID list included in an MBMS service context corresponding to an MBMS service identified by the MBMS service ID included in the message 641 and all RNCs included in an RA to which UEs in the PMM-Idle mode belong of initiation of MBMS data transmission through the MBMS Service Availability message. Upon receiving the message, the RNC 611 sends a Notification to the UEs by using MBMS service ID information included in the message 641.

The notification process will be briefly described below. The UEs and the RNC calculate the same PO (Paging Occasion) and PI (Paging Instance) values using the MBMS service ID (for example, TMGI) and a DRX parameter, and the RNC turns on or off a pilot indication channel (PICH) for a time period indicated by the PI and the PO to indicate whether a related paging channel (PCH) for UEs is received, and sends a Notification message to an associated PCH that starts a predetermined time after the PICH.

However, in order to send the Notification message to the UE in the Cell DCH mode, the RNC uses a Paging Type 2 message through a DCCH channel separately established for the UE. As mentioned above, the Service Availability message 641 does not include a UE ID, and the RNC 611 must store a mapping relation between the MBMS service ID and the UE ID of the UE in order to send the Notification message to the UE 601. However, because the UE transitions to the PMM-Idle mode, the mapping relation between the UE 601 and the MBMS service is deleted from the RNC 611 through the Delete MBMS Context Request message 531 and the Delete MBMS Context Response message 532 of FIG. 5. For this reason, when using a conventional art, it is impossible to send an MBMS

Notification to the UE 601 in the PMM-Idle/RRC-Connected mode. The UE failing to receive the Notification message cannot receive MBMS data even through successfully joining the MBMS service.

[SUBSTANTIAL MATTER OF THE INVENTION]

It is, therefore, an object of the present invention to provide a method for holding an MBMS service context for an UE in a PMM-Idle/RRC-Connected mode in an RNC.

It is another object of the present invention to provide a method where, in a mobile communication service which provides an MBMS service, when a UE transitioning to a PMM-Idle mode after joining the MBMS service sets up RRC connection, it transmits MBMS service related information to an RNC and the RNC manages an MBMS context for a UE in an RRC-Connected mode in the RNC by a procedure of determining whether the UE is a valid UE joining the MBMS service through an SGSN in order to provide the MBMS service to all UEs.

It is further another object of the present invention to provide a method for managing an MBMS service context in an RNC for an MBMS service according to an RRC state of a UE. .

It is yet another object of the present invention to provide a method for holding an MBMS service context for a UE in an RRC-Connected mode in an RNC to manage the MBMS service context in the RNC according to an RRC state of the UE.

It is yet another object of the present invention to provide a method for defining a procedure for transmitting an MBMS service ID to an RNC when an

UE creates RRC connection to manage the MBMS service context in the RNC according to an RRC state of the UE.

It is yet another object of the present invention to provide a method for defining a procedure in which an RNC inquires of an SGSN about whether a UE joins an MBMS service to manage the MBMS service context in the RNC according to an RRC state of the UE.

In accordance with one aspect of the present invention, there is provided in a mobile communication system including a Node B and multiple user equipments (UEs) capable of communicating with the Node B in a cell occupied by the Node B where multimedia broadcast/multicast service (MBMS) data can be transmitted from the Node B to a plurality of UEs among the multiple UEs, a method for transmitting information of UEs requesting a predetermined MBMS service to a radio network controller (RNC) when the UEs are in a Iu-PS signaling connection released state after requesting the MBMS service, the method including transmitting, by each of the UEs, ID information of the UE to the RNC when setting up RRC connection to the RNC.

In accordance with another aspect of the present invention, in order for the RNC to determine whether the UE is a valid UE capable of receiving the MBMS service, the method includes the steps of transmitting ID information of the UE through an MBMS UE Validate Request message, determining, by the SGSN having received the message, whether the UE is valid through its MBMS service context, and transmitting, by the SGSN, the determination result to the RNC through an MBMS UE Validate Response message.

[CONSTRUCTION AND OPERATION OF THE INVENTION]

Several preferred embodiments of the present invention will now be

described in detail with reference to the annexed drawings. In the following description, two representative embodiments of the present invention will be suggested to achieve the foregoing technical problems. Other embodiments implied by the present invention will be substituted by descriptions in the present invention.

FIG. 7 is a diagram illustrating a procedure for inserting information on an UE to an MBMS service context of an RNC by transmitting an MBMS service ID to the RNC when the UE joining an MBMS service but being in a PMM-Idle mode sets up RRC connection for a circuit switched (CS) service. In other words, when the UE requesting the MBMS service sets up RRC connection, the RNC indicates whether the UE has RRC connection or requests the MBMS although the RRC connection is for the CS service or a packet service. Reference numeral 701 represents a UE receiving an MBMS service and reference numeral 711 represents an RNC for the MBMS service corresponding to the UE. Reference numeral 721 represents an SGSN of a CN for the MBMS service.

FIG. 7A illustrates a first embodiment of the present invention where an MBMS service ID is inserted to an existing RRC connection message. Through steps 731, 732, and 733, a UE 701 sets up RRC connection to an RNC 711. The UE inserts an MBMS service ID to an RRC Connection Setup Request message 731 or an RRC Connection Setup Complete message 733 to request addition of information on the UE to an MBMS service context corresponding to the MBMS service ID. In other words, in the first embodiment of the present invention, if a Service ID is transmitted to the RNC at a point of time when RRC connection is set up, the RNC updates the MBMS service context. That is, by transmitting the Service ID through insertion, it can be indicated that the UE requests the MBMS service in step 731 or 733. If an RRC connection is successfully set up between the UE 701 and the RNC 711 through steps 731, 732, and 733, the RNC

504 manages an MBMS service context as illustrated in FIG. 3 but different information. Conventionally, UEs requesting MBMS services are managed by an SGSN and thus information about a UE requesting an MBMS service is acquired from the SGSN. However, in the present invention, by transmitting a Service ID at the time of RRC connection, the RNC, which cannot know information about a UE having RRC connection for a CS service according to conventional techniques, manages a list of UEs setting up RRC connection of the CS service in an MBMS service context. Thus, the RNC can know information on UEs setting up RRC connection for a CS service or a packet service among UEs requesting MBMS services. As such, after the UE transmits information indicating that it is a UE requesting an MBMS service at the time of RRC connection and thus the RNC updates the MBMS service context, the RNC cannot determine whether the UE is a valid UE joining the MBMS service, it requests the SGSN 721 to validate the UE. If the UE is valid, the RNC holds the MBMS service context. If the UE is not valid, the RNC deletes information on the UE from the MBMS service context. Update of the MBMS service context may be performed after step 733, or after step 742 as illustrated in FIG. 7A, i.e., after determination of validity of UE's MBMS service joining. To this end, an MBMS UE Validate Request message 741 may be used. The In step 516, the RNC 504 uses an MBMS UE Validate Request message to determine whether the UE 502 is valid for the requested MBMS service. The MBMS UE Validate Request message 741 may include a UE ID, an MBMS service ID, and an RNC ID. Further, the MBMS UE Validate Request message is transferred from the RNC 504 to the SGSN 506.

Since the UE 701 is in a PMM-Idle mode, a dedicated signaling bearer allocated for the UE 701 does not exist between the RNC 711 and the SGSN 721. Therefore, the MBMS UE Validate Request message 741 can be transmitted using a common signaling bearer created for a corresponding MBMS service, or transmitted using a connectionless signaling transmission method. If the message

741 is transmitted using the first method, the SGSN 721 can check the signaling bearer transmitting the message 741 to identify the MBMS service and the RNC 711, for which the MBMS service ID and the RNC ID may not be included in the message. If the message 741 is transmitted using the second method, the MBMS service ID and the RNC ID must be included in the message.

If the MBMS service context corresponding to the MBMS service ID included in the message exists in the SGSN and the UE ID included in the message exists in the MBMS service context, the SGSN 721 having received the MBMS UE Validate Request message informs the RNC 711 that the UE 701 is a valid UE for the MBMS service. The SGSN also has RRC connection in MBMS service context information managed by the SGSN and adds information on the RNC to which the UE requesting the MBMS service belongs. If the SGSN has already had information on the RNC requesting the MBMS service, re-addition is not required. In case of first request for the MBMS service from the RNC, the information on the RNC is added. At this time, an MBMS UE Validate Response message 742 may be used. The MBMS UE Validate Response message may include information on an area where the MBMS service is available. For example, the information may be a service area code (SAC) or multicast area information. If, based on the service area information, it is determined that the UE 701 is located in a cell not belonging to an area where the MBMS service is available, the RNC 711 can request the UE 701 to move to another cell.

If the RNC corresponding to the RNC ID included in the MBMS UE Validate Request message 741 does not exist in the MBMS service context of the SGSN 721, the information on the RNC is added to the MBMS service context.

The RNC 711 having received the MBMS UE Validate Response message 742 adds the information on the UE to the MBMS service context. If the

MBMS service context corresponding to the MBMS service ID included in the message 731 or 733 does not exist in the RNC, the MBMS service context must be first created.

When the UE that joins the MBMS service but is in the PMM-Idle mode sets up RRC connection for other packet services than the MBMS service, information on the UE may be added to the MBMS service context of the RNC through the procedure illustrated in FIG. 7A.

FIG. 7B illustrates a second embodiment where an MBMS service ID is transmitted from an UE to an RNC through a newly defined RRC procedure. In the second embodiment, the RNC is informed that the MBMS service is requested separately from the RRC connection setup flow.

The UE 701 sets up RRC connection to the RNC 711 by using the RRC connection setup procedure 751. In step 761, the UE delivers an MBMS service ID to the RNC through an MBMS Service Request message. The MBMS Service Request message includes the MBMS service ID.

Operations of steps 741 and 742 of FIG. 7B performed after the RNC receives the MBMS service ID through step 761 is similar to the corresponding operation illustrated in FIG. 7A. That is, the RNC inquires of the SGSN by using steps 741 and 742 of FIG. 7A to determine whether the UE is a valid UE joining the MBMS service. If successfully receiving a response from the SGSN, the RNC 711 adds information on the UE to the MBMS service context as described with reference to FIG. 7A.

Next, the RNC 711 informs the UE 701 that the context for the MBMS service is created in the RNC through the MBMS Service Response message 762.

If the RNC 711 instructs the UE 701 to move to another cell because the current cell to which the UE 701 belongs does not provide the MBMS service, a cell ID may be included in the MBMS Service Response message in step 762.

If the SGSN 721 is requested to determine whether the UE is a valid UE joining the MBMS service through steps 741 and 742 of FIG. 7B, but the SGSN fails to determine whether the UE is the valid UE capable of receiving the MBMS service, the SGSN informs the RNC 711 that the UE does not join the MBMS service through the SGSN by using an MBMS Validate Failure message in step 743. Alternatively, the SGSN may inform this fact by inserting a cause value to the MBMS Validate Response message 742.

The RNC 711 recognizing this fact does not add information on the UE 701 to the MBMS service context. The RNC informs the UE that it is impossible to receive the MBMS service through the RNC by using the MBMS Service Failure message 763. The RNC may also inform this fact by inserting a cause value to the MBMS Service Response message 762.

Parameters inserted to existing messages according to the present invention are as follows:

1. RRC Connection Setup Request 731
   Parameter: MBMS service ID
2. RRC Connection Setup Complete 732
   Parameter: MBMS service ID

In addition, newly defined messages and added parameters according to the present invention are as follows. The messages used in steps 741 and 742 are used to determine whether the UE joined the MBMS service.

1. MBMS UE Validate Request 741

1) Parameter: UE ID, MBMS service ID, RNC ID

2) Signaling Bearer: Signaling bearer for each MBMS service or Connectionless signaling bearer for each UE

3) Transmission Direction: RNC -> SGSN

2. MBMS UE Validate Response 742

1) Parameter: SAC, Multicast Area Information, Cause

2) Signaling Bearer: Signaling bearer for each MBMS service or Connectionless signaling bearer for each UE

3) Transmission Direction: SGSN -> RNC

3. MBMS UE Validate Failure 743

1) Parameter: Cause

2) Signaling Bearer: Signaling bearer for each MBMS service or Connectionless signaling bearer for each UE

3) Transmission Direction: SGSN -> RNC

4. MBMS Service Request 741

1) Parameter: MBMS service ID

2) Transmission Direction: UE -> RNC

5. MBMS Service Response 742

1) Parameter: Cell ID, Cause

2) Signaling Bearer: Signaling bearer for each MBMS service or Connectionless signaling bearer for each UE

3) Transmission Direction: RNC -> UE

6. MBMS Service Failure 743

1) Parameter: Cause

2) Transmission Direction: RNC -> UE

FIG. 8 is a flowchart illustrating operation of a UE according to an embodiment of the present invention, described with reference to FIG. 7.

In step 801, the UE joins an MBMS service through the procedure described in connection with FIG. 4. In step 802, the UE monitors whether RRC connection is released. If the UE senses release of the RRC connection in step 802, it monitors in step 811 whether there is an RRC connection reconfiguration request. If it is determined that there is an RRC connection reconfiguration request, the UE sends an MBMS service ID indicating the MBMS service joined by the UE to the RNC 504 to which the RRC connection is to be set up in step 821 for call establishment for a CS service or a packet service. In step 821, the UE may insert an MBMS service ID into an RRC Connection Setup Request message in step 731 or an RRC Connection Setup Complete message in step 733 according to the first embodiment as illustrated in FIG. 7A.. According to the second embodiment as illustrated in FIG. 7B, the UE may insert the MBMS service ID to a newly defined message such as the MBMS Service Request message in step 761.

FIG. 9 is a flowchart illustrating operations of the RNC that manages a MBMS service context, according to the procedures illustrated in FIG. 7. The method for managing the MBMS service context is the same as a conventional method and thus will not be described and only an added management method in the present invention will be described.

In step 901, the RNC receives an RRC Connection Setup Request message from the UE which releases PS signaling according to the procedure described with reference to FIG. 5 after joining the MBMS service according to the procedure described with reference to FIG. 4.

In step 902, the RNC monitors whether an MBMS service ID is received from the UE. The MBMS service ID may be transmitted from the UE to the RNC in the RRC connection setup procedure (i.e., indicating the UE is a UE that joins

the MBMS service in step 731 according to the first embodiment of FIG. 7A), or through an additional message (i.e., indicating the UE is a UE that joins the MBMS service in step 733 according to the first embodiment of FIG. 7B) after RRC connection setup.

If the RNC receives the MBMS service ID in step 902, the RNC requests the SGSN to determine whether the UE is a valid UE that joins a service identified by the MBMS service ID in step 921. In step 921, the MBMS UE Validate Request message of step 741 of FIG. 7 is used. If the RNC fails to receive the MBMS service ID, the RNC terminates its operation.

In step 922, the RNC monitors whether a response requested in step 921 is successfully received from the SGSN. In step 922, the MBMS UE Validate Response message of step 742 of FIG. 7 is used. If the RNC fails to successfully receive the response from the SGSN in step 922, the RNC terminates its operation.

In step 931, the RNC determines whether the MBMS service context corresponding to the MBMS service ID received in step 901 exists.

If the MBMS service context exists in step 932, the RNC determines whether an ID of the UE is included in the MBMS service context in step 951. If the information on the UE is not included in the MBMS service context, the information on the UE is added. If the MBMS service context does not exist in step 932, the RNC creates the MBMS service context corresponding to the MBMS service ID received in step 901. In step 942, the information on the UE is added to the created MBMS service context. Then the RNC terminates its operation. In step 943, the RNC stores information about a mapping relation between the UE context for the UE and the MBMS service context.

In step 952, the RNC determines whether the ID of the UE is included in the MBMS service context found in step 932. If the ID of the UE is not included in the MBMS service context in step 952, the RNC adds the information on the UE to the MBMS service context. In step 943, the RNC stores a mapping relation between the UE context for the UE and the MBMS service context. If the ID of the UE is included in the MBMS service context in step 952, the RNC terminates its operation.

According to the embodiment of FIG. 7B, if the RNC fails to successfully receive the response from the SGSN, it informs the UE that it is impossible to receive the MBMS service through the RNC in step 911.

FIG. 10 is a diagram illustrating an operation flow of an SGSN according to an embodiment of the present invention.

In step 1001, the SGSN receives from the RNC a request for determining whether the UE is a valid UE that joins a service identified by the MBMS service ID. In step 1001, the UE ID, the MBMS service ID, and the RNC ID are transmitted from the RNC to the SGSN through the MBMS UE Validate Request message of step 741 of FIG. 7.

The SGSN may selectively perform MBMS service authentication for the UE. In other words, the SGSN having received the MBMS UE Validate Request message of step 741 determines whether the UE is a valid UE that joins the MBMS service and may perform corresponding service authentication. If service authentication is successful in step 1002, the SGSN determines whether the MBMS service context corresponding to the MBMS service ID received in step 1001 exists in step 1021. Thus, RNC information containing the UE

requesting the MBMS service can be added to the MBMS service context of the SGSN. If service authentication fails in step 1002, the SGSN informs the RNC that the UE is not a UE that joins the MBMS service through the SGSN by using the MBMS UE Validate Failure message of step 743 in step 1010, and then terminates its operation.

If the MBMS service context exists in step 1022, the SGSN determines whether an ID of the UE is included in the MBMS service context in step 1031. If there is no MBMS service context in step 1022, the SGSN informs the RNC that the UE is not a UE that joins the MBMS service through the SGSN by using the MBMS UE Validate Failure message of step 743 in step 1011, and then terminates its operation.

In step 1032, the SGSN determines whether the ID of the UE is included in the MBMS service context found through step 1021. If the ID of the UE is not included, the SGSN informs the RNC that the UE is not a UE that joins the MBMS service through the SGSN by using the MBMS UE Validate Failure message of step 743 in step 1011, and then terminates its operation. If the ID of the UE is included in the MBMS service context in step 1032, the SGSN informs the RNC that the UE is a UE that joins the MBMS service through the SGSN in step 1041. In step 1041, the SGSN uses the MBMS UE Validate Response message of step 432 of FIG. 7.

In step 1042, the SGSN determines whether the RNC ID received in step 1001 is included in the MBMS service context found through step 1031. If the RNC ID is not included in the MBMS service context in step 1043, the SGSN adds information on the RNC to the MBMS service context. If the RNC ID is included in the MBMS service context in step 1043, the SGSN terminates its operation.

[EFFECTS OF THE INVENTION]

As can be appreciated from the foregoing description, when UEs having joined an MBMS service are in an RRC-Connected mode after setting up a call for a CS service or a PS service, the present invention prevents the UEs from failing to receive a notification for paging of the MBMS service in providing the MBMS service, thereby increasing success rate and reliability of MBMS paging.

[PATENT CLAIMS]

1. In a mobile communication system comprising a Node B and multiple user equipments (UEs) capable of communicating with the Node B in a cell occupied by the Node B where multimedia broadcast/multicast service (MBMS) data can be transmitted from the Node B to a plurality of UEs among the multiple UEs, a method for the UEs requesting a predetermined MBMS service to receive an MBMS Notification for the MBMS service when RRC connection is set up after the predetermined MBMS service is requested, the method comprising the step of:

transmitting, by each of the UEs, ID information of the MBMS service the UE requests to a radio network controller (RNC) when setting up RRC connection to the RNC.

2. The method of claim 1, wherein the MBMS service ID information transmitted by the UE to the RNC is transmitted through an RRC Connection Setup Request message transmitted during the RRC connection setup.

3. The method of claim 1, wherein the MBMS service ID information transmitted by the UE to the RNC is transmitted through an RRC Connection Setup Complete message transmitted during the RRC connection setup.

4. The method of claim 1, wherein the UE generates a predetermined MBMS Service Request message after setting up RRC connection to the RNC to transmit the MBMS service ID information through the MBMS Service Request message.

5. The method of claim 1, further comprising the step of transmitting, by the RNC having received the MBMS service ID information, ID

information of the UE having transmitted the MBMS service ID information to a serving GPRS (General Packet Radio Service) support node (SGSN) to determine whether the UE is a valid UE capable of receiving a corresponding MBMS service.

6. The method of claim 5, further comprising, in order for the RNC to determine whether the UE is a valid UE capable of receiving the MBMS service, the steps of:

transmitting, by the RNC, the ID information of the UE through an MBMS UE Validate Request message;

determining, by the SGSN having received the message, whether the UE is valid through its MBMS service context; and

transmitting, by the SGSN, the determination result to the RNC through an MBMS UE Validate Response message.

7. The method of claim 6, wherein if the UE is not a UE valid for reception of the MBMS service as a result of determination by the SGSN, the SGSN transmits the result through an MBMS UE Validate Failure message.

8. The method of claim 6, wherein the MBMS UE Validate Request message is transmitted through a common signaling bearer previously created for the MBMS service.

9. The method of claim 6, wherein the MBMS UE Validate Request message is transmitted using a connectionless signaling transmission method.

10. The method of claim 9, wherein when the UE Validate Request message is transmitted using the connectionless signaling transmission method, MBMS service ID information and RNC ID information are further transmitted

along with the UE Validate Request message.

11. In a mobile communication system comprising a Node B and multiple user equipments (UEs) capable of communicating with the Node B in a cell occupied by the Node B where multimedia broadcast/multicast service (MBMS) data can be transmitted from the Node B to a plurality of UEs among the multiple UEs, a method for managing an MBMS service context of a UE setting up RRC connection after requesting a predetermined MBMS service, the method comprising the steps of:

receiving, by each of the UEs, ID information of the MBMS service the UE requests when setting up RRC connection to a radio network controller (RNC); and

adding information on the UE to an MBMS service context corresponding to the received MBMS service ID information.

12. In a mobile communication system comprising a Node B and multiple user equipments (UEs) capable of communicating with the Node B in a cell occupied by the Node B where multimedia broadcast/multicast service (MBMS) data can be transmitted from the Node B to a plurality of UEs among the multiple UEs, a method for determining whether a UE setting up RRC connection after requesting a predetermined MBMS service requests the service, the method comprising the steps of:

receiving, by each of the UEs, ID information of the MBMS service the UE requests when setting up RRC connection to the RNC;

requesting determination of whether the UE requests the MBMS service by including the received MBMS service ID information; and

storing information on the RNC in which the UE requesting the MBMS service is included according to the determination result.

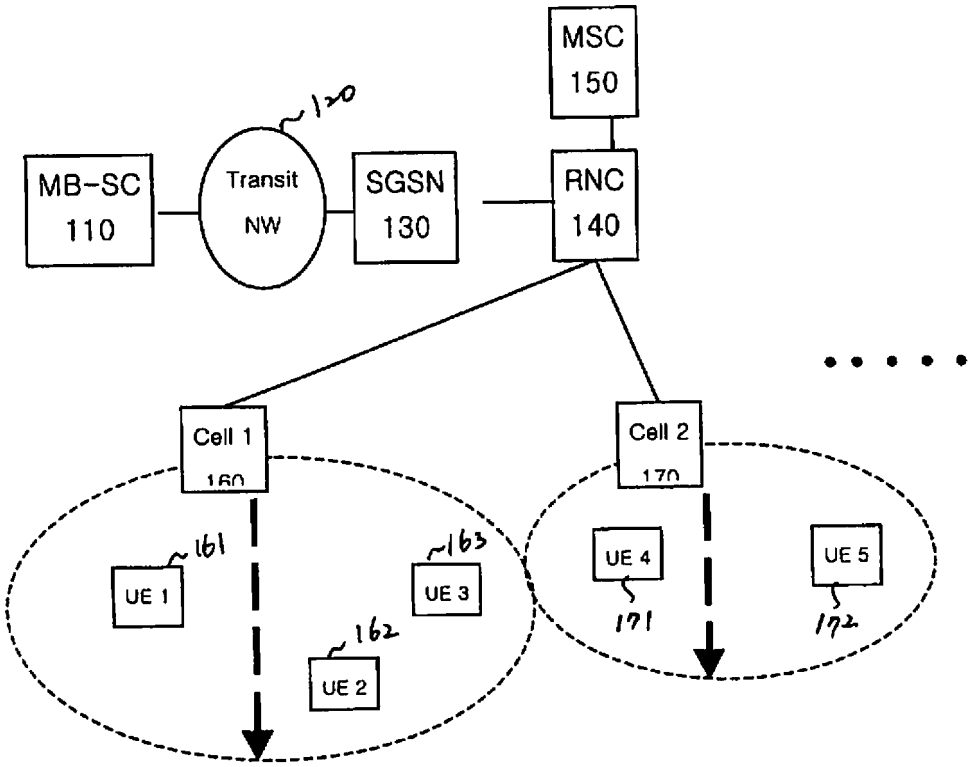

MSC
150
120
MB-SC
110
Transit
NW
SGSN
130
RNC
140
Cell 1
160
Cell 2
170
161
UE 1
163
UE 3
162
UE 2
UE 4
171
UE 5
172

FIG. 1

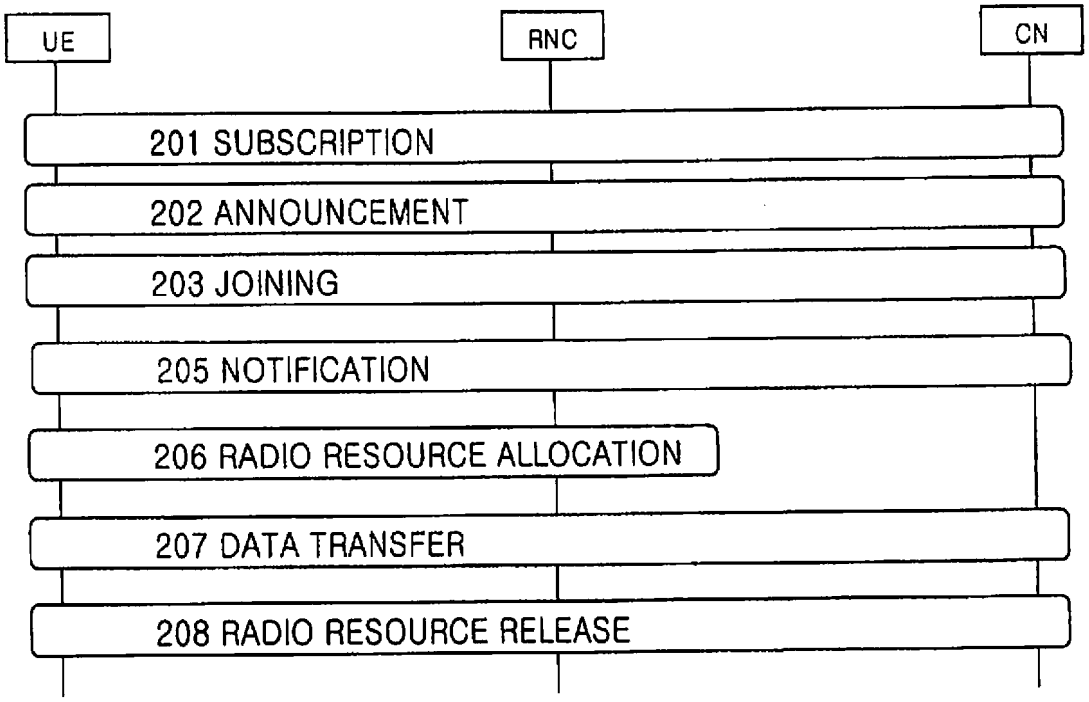

UE
RNC
CN
201 SUBSCRIPTION
202 ANNOUNCEMENT
203 JOINING
205 NOTIFICATION
206 RADIO RESOURCE ALLOCATION
207 DATA TRANSFER
208 RADIO RESOURCE RELEASE

FIG. 2

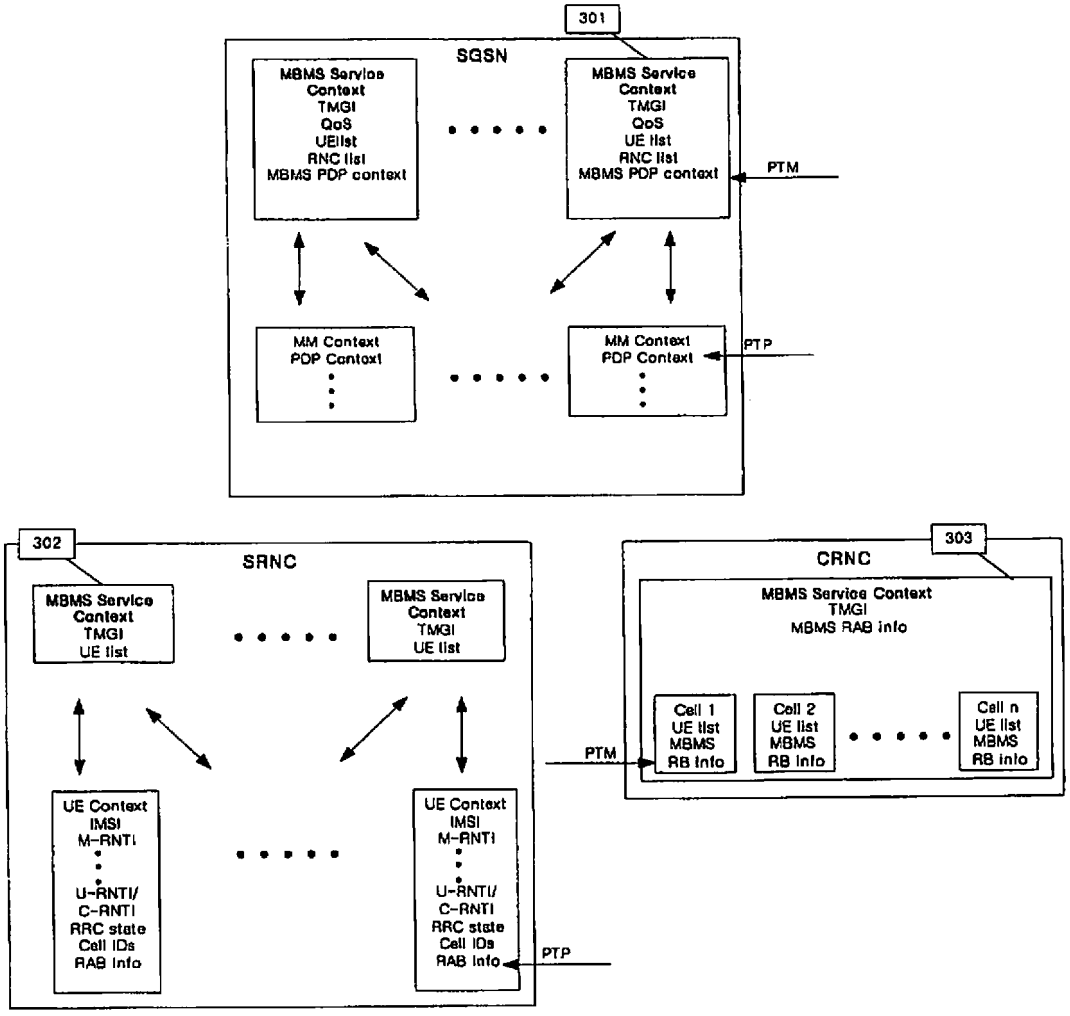

301
SGSN
MBMS Service Context
TMGI
QoS
UEIist
RNC list
MBMS PDP context
MBMS Service Context
TMGI
QoS
UE list
RNC list
MBMS PDP context
PTM
MM Context
PDP Context
MM Context
PDP Context
PTP
302
SRNC
MBMS Service Context
TMGI
UE list
MBMS Service Context
TMGI
UE list
UE Context
IMSI
M-RNTI
U-RNTI/
C-RNTI
RRC state
Cell IDs
RAB info
UE Context
IMSI
M-RNTI
U-RNTI/
C-RNTI
RRC state
Cell IDs
RAB info
PTP
303
CRNC
MBMS Service Context
TMGI
MBMS RAB info
Cell 1
UE list
MBMS
RB info
Cell 2
UE list
MBMS
RB info
Cell n
UE list
MBMS
RB info
PTM

FIG. 3

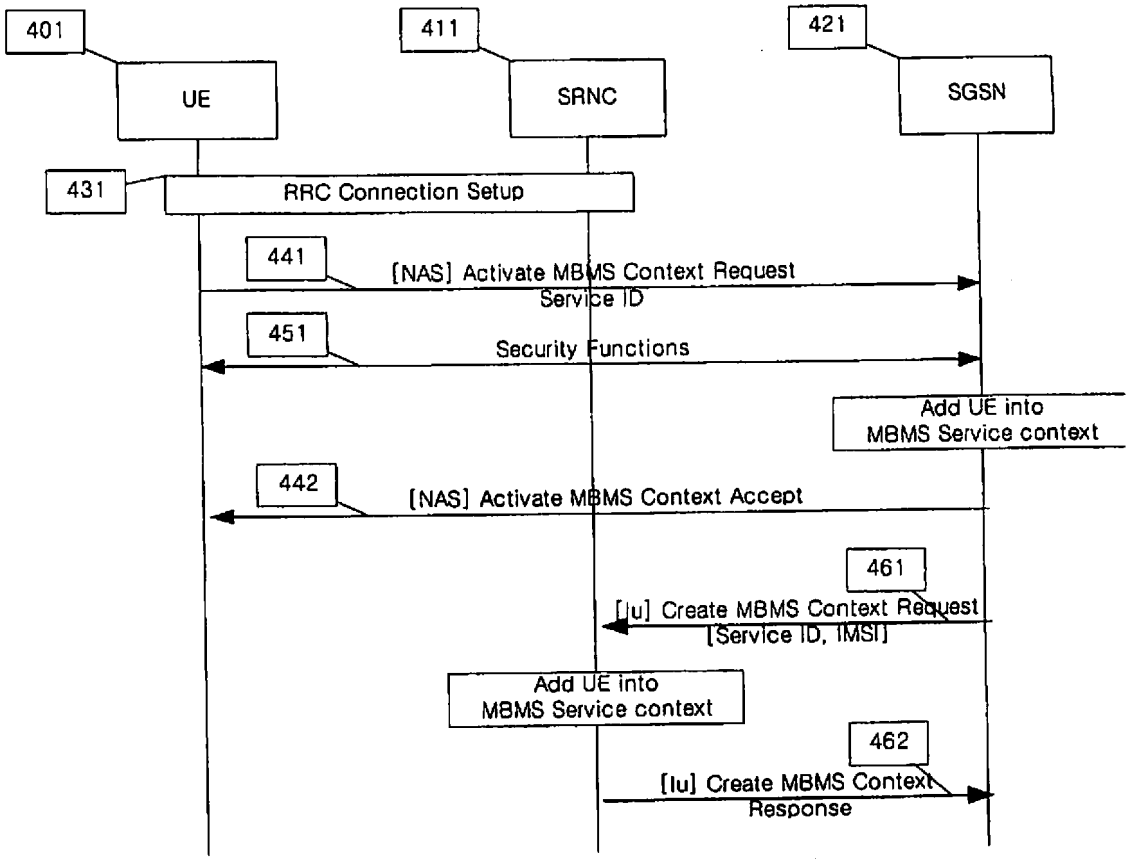

401
UE
411
SRNC
421
SGSN
431
RRC Connection Setup
441
[NAS] Activate MBMS Context Request
Service ID
451
Security Functions
Add UE into
MBMS Service context
442
[NAS] Activate MBMS Context Accept
461
[Iu] Create MBMS Context Request
[Service ID, IMSI]
Add UE into
MBMS Service context
462
[Iu] Create MBMS Context
Response

FIG. 4

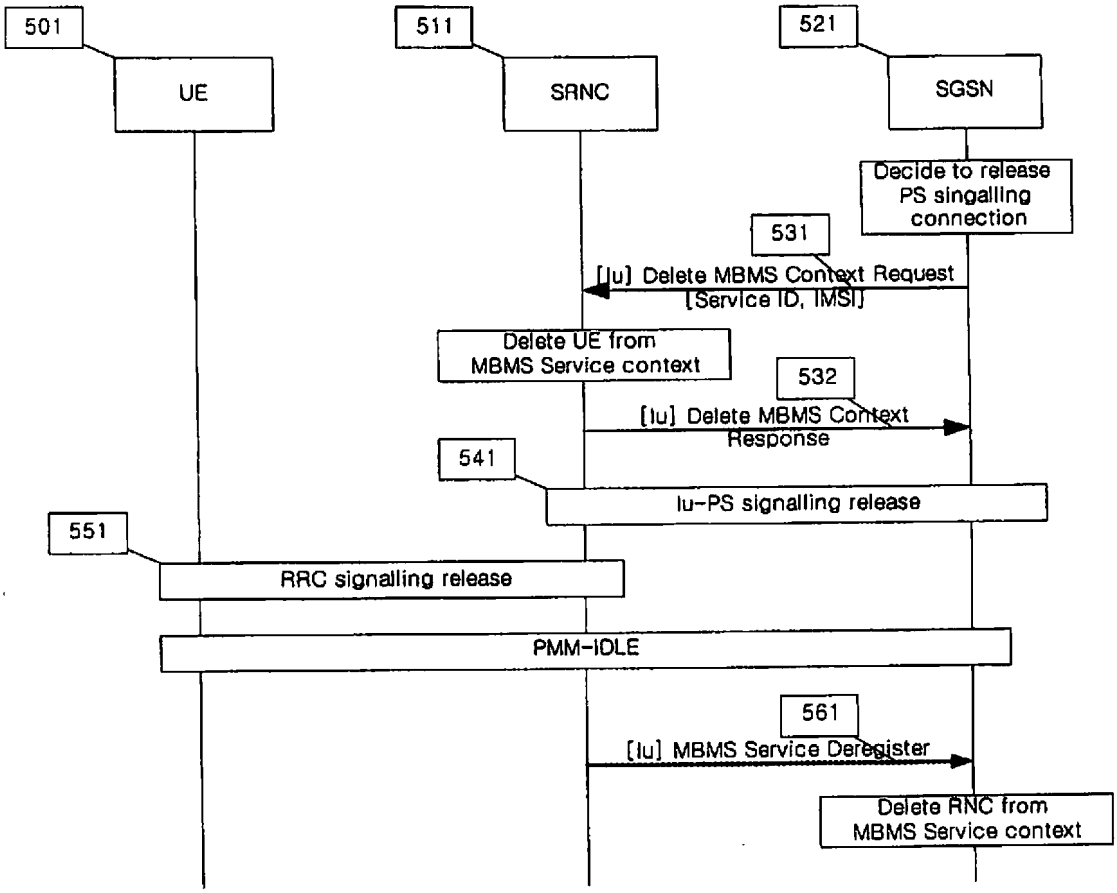

501
UE
511
SRNC
521
SGSN
Decide to release PS singalling connection
531
[Iu] Delete MBMS Context Request
[Service ID, IMSI]
Delete UE from MBMS Service context
532
[Iu] Delete MBMS Context Response
541
Iu-PS signalling release
551
RRC signalling release
PMM-IDLE
561
[Iu] MBMS Service Deregister
Delete RNC from MBMS Service context

FIG. 5

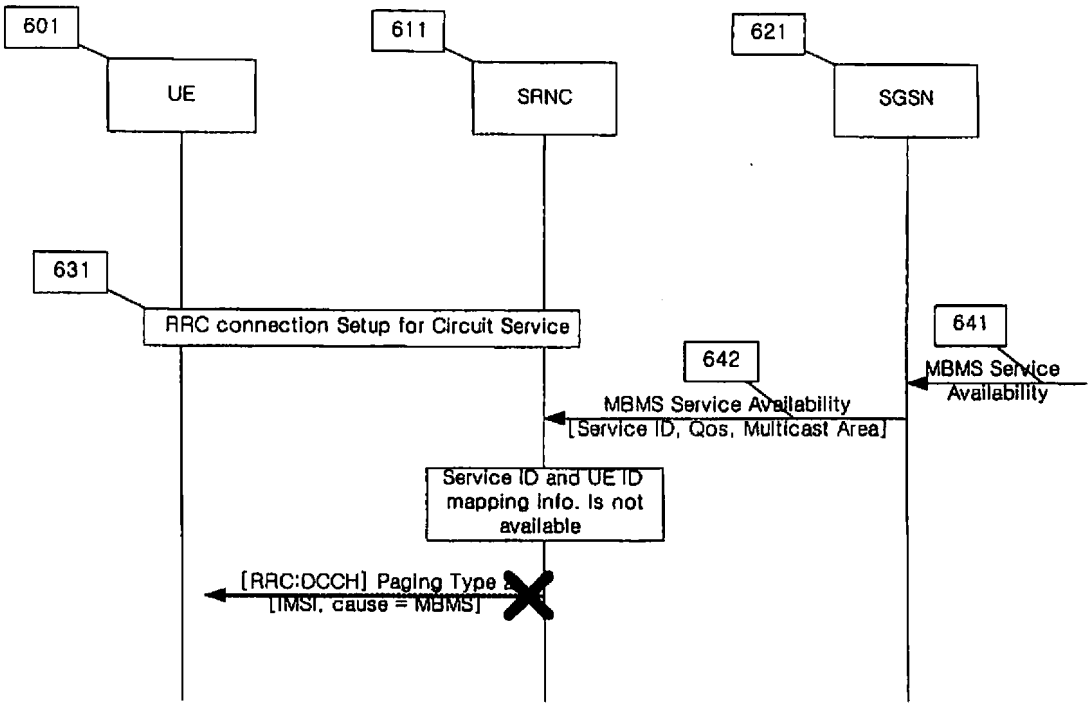

601
UE
611
SRNC
621
SGSN
631
RRC connection Setup for Circuit Service
641
MBMS Service Availability
642
MBMS Service Availability
[Service ID, Qos, Multicast Area]
Service ID and UE ID mapping info. is not available
[RRC:DCCH] Paging Type
[IMSI, cause = MBMS]

FIG. 6

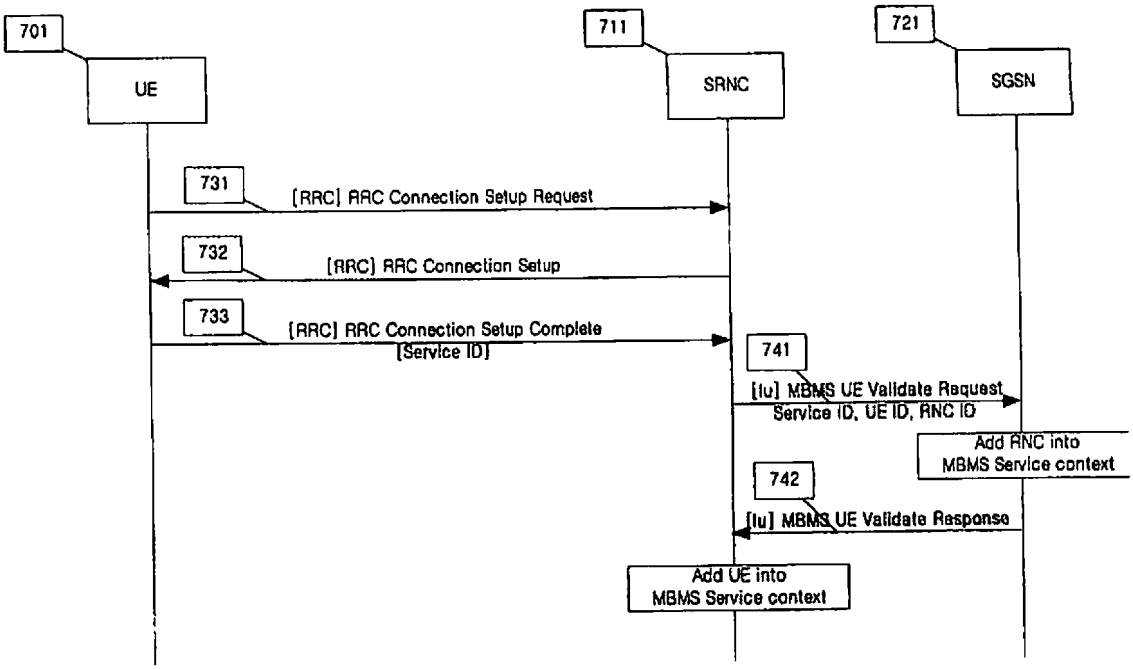

701
UE
711
SRNC
721
SGSN
731
[RRC] RRC Connection Setup Request
732
[RRC] RRC Connection Setup
733
[RRC] RRC Connection Setup Complete
[Service ID]
741
[Iu] MBMS UE Validate Request
Service ID, UE ID, RNC ID
Add RNC into
MBMS Service context
742
[Iu] MBMS UE Validate Response
Add UE into
MBMS Service context

FIG. 7a

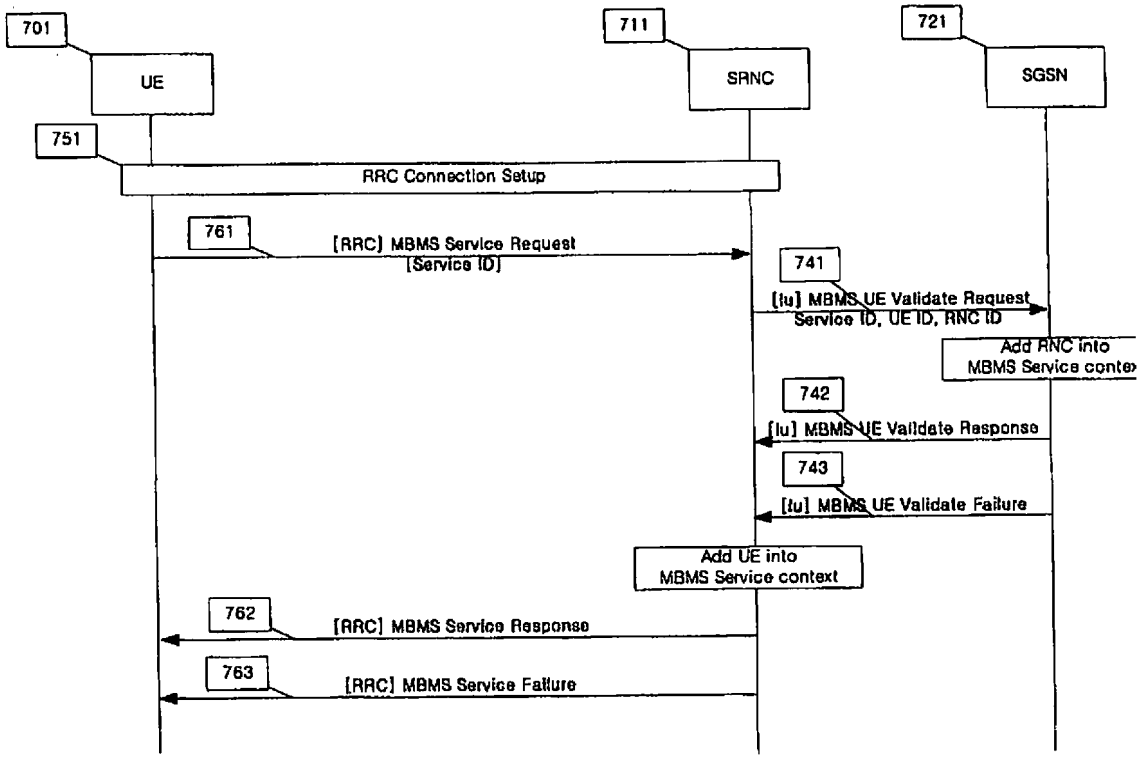

701
UE
711
SRNC
721
SGSN
751
RRC Connection Setup
761
[RRC] MBMS Service Request
[Service ID]
741
[Iu] MBMS UE Validate Request
Service ID, UE ID, RNC ID
Add RNC into
MBMS Service conte
742
[Iu] MBMS UE Validate Response
743
[Iu] MBMS UE Validate Failure
Add UE into
MBMS Service context
762
[RRC] MBMS Service Response
763
[RRC] MBMS Service Failure

FIG. 7b

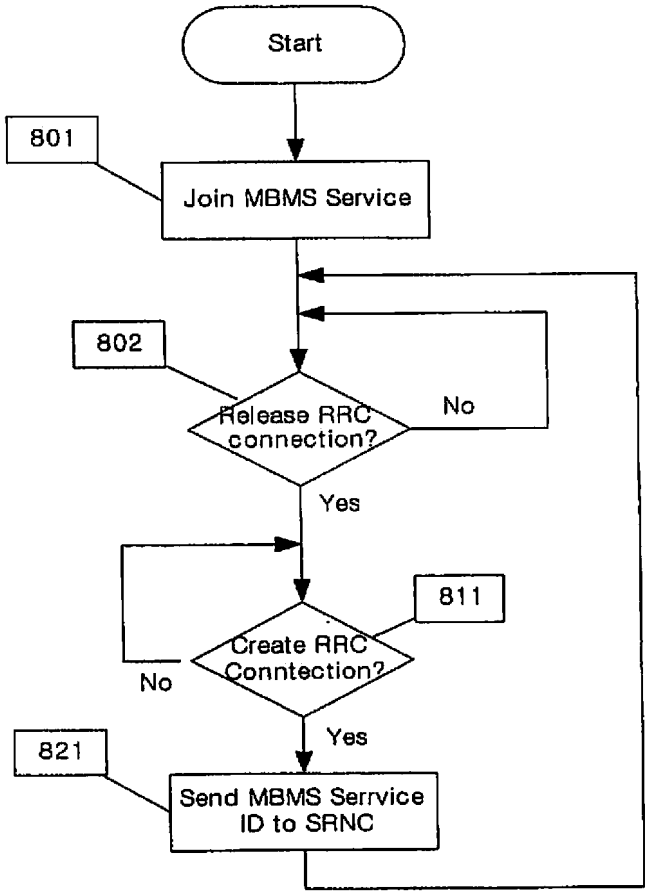

Start
801
Join MBMS Service
802
Release RRC connection?
No
Yes
811
Create RRC Conntection?
No
Yes
821
Send MBMS Serrvice ID to SRNC

FIG. 8

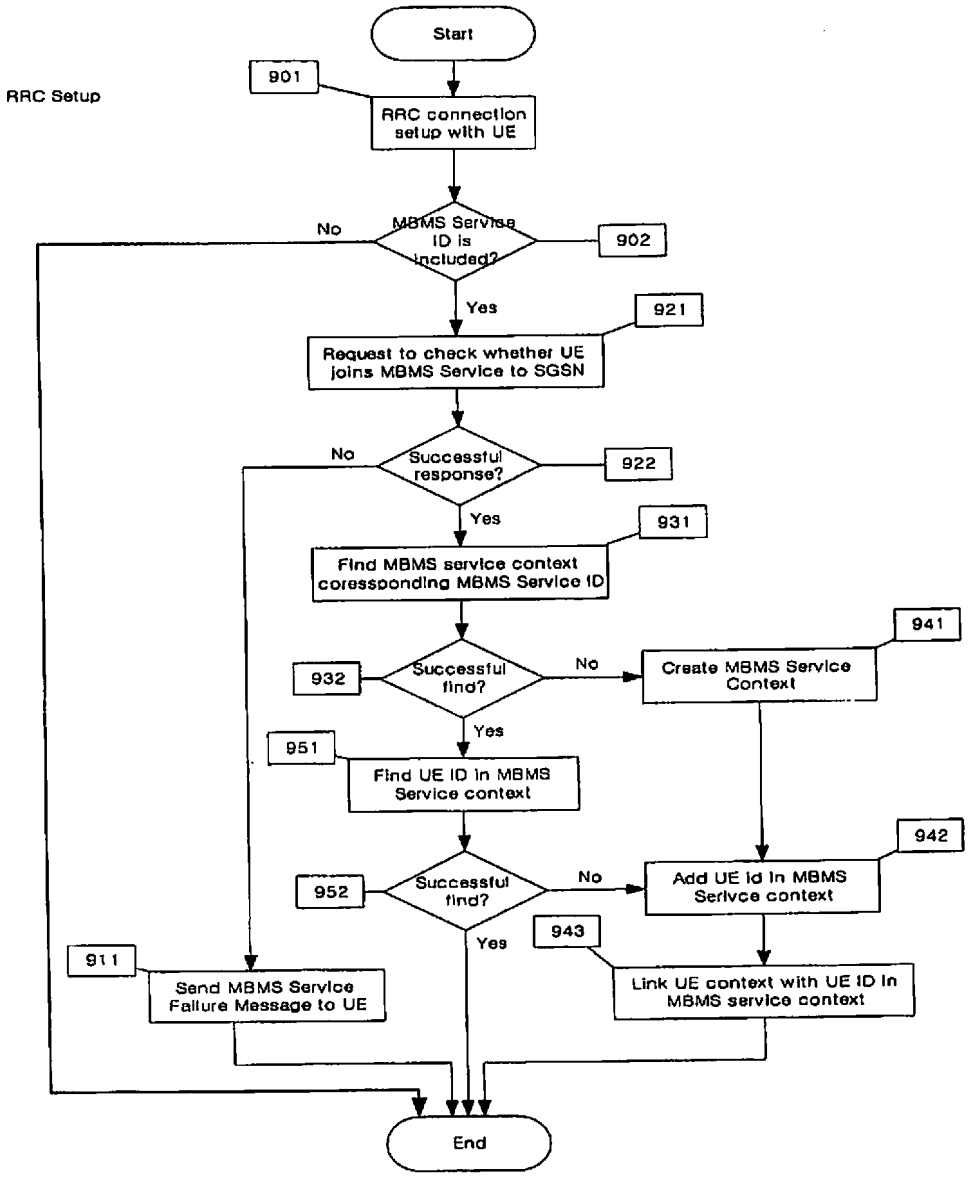
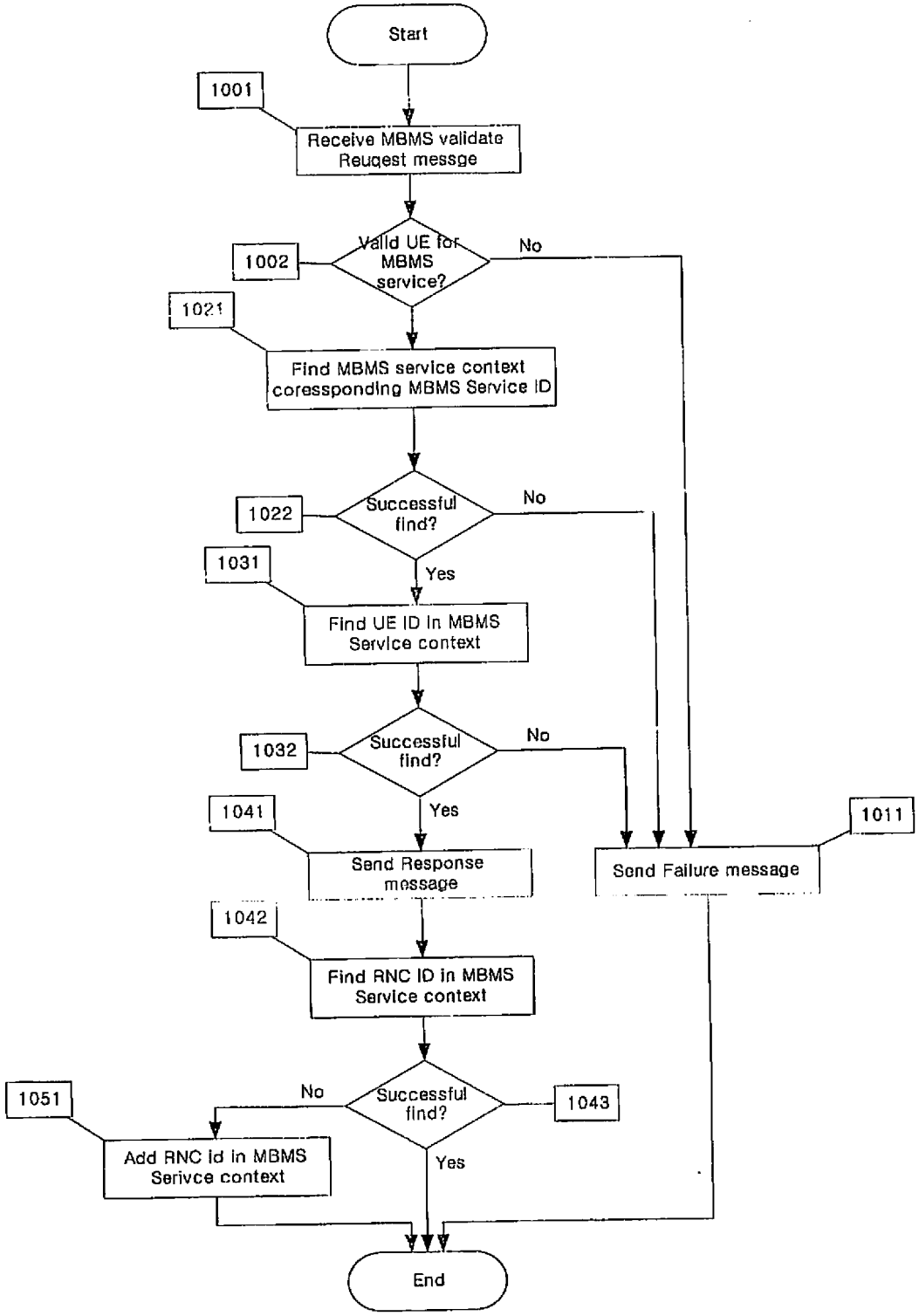

RRC Setup
Start
901
RRC connection setup with UE
MBMS Service ID is included?
No
902
Yes
921
Request to check whether UE joins MBMS Service to SGSN
Successful response?
No
922
Yes
931
Find MBMS service context coressponding MBMS Service ID
941
Successful find?
932
No
Create MBMS Service Context
Yes
951
Find UE ID in MBMS Service context
942
Successful find?
952
No
Add UE id in MBMS Serivce context
Yes
943
911
Send MBMS Service Failure Message to UE
Link UE context with UE ID in MBMS service context
End

FIG. 9

[FIG. 10_]


Start
1001
Receive MBMS validate Reugest messge
1002
Valid UE for MBMS service?
No
1021
Find MBMS service context coressponding MBMS Service ID
1022
Successful find?
No
Yes
1031
Find UE ID In MBMS Service context
1032
Successful find?
No
Yes
1041
Send Response message
1011
Send Failure message
1042
Find RNC ID in MBMS Service context
1051
No
Successful find?
1043
Add RNC Id in MBMS Serivce context
Yes
End